

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

Mr. Philip Lapsansky
Library Company of Philadelphia
1314 Locust St.
Philadelphia, PA 19107-5698

April 3, 1996

Dear Phil:

I have the full text on the article on "Coinage" in the Supplement to the Fourth, Fifth and Sixth Editions of the Encyclopedia Britannica in volume third (Edinburgh 1824), including plates LXI, LXII, LXIII and LXIV. I believe you have the text so I enclose photocopies of the plates which are marked "coining".

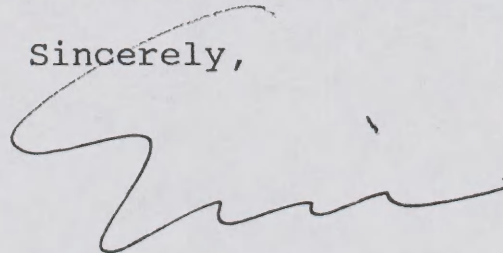
I do not have the text or plates for the second, third, fourth, fifth or sixth edition of any article on Coinage or Coining except for three loose plates CC, CCI and CCII which I cannot readily date. Those plates also include "Old Coining Apparatus used in the Tower" which was vacated about 1810. Some editions, no doubt, repeated articles from prior editions. For what period the Coinage or Coining article ran in the first edition will be helpful to know.

Perhaps you can clear up some of this from your holdings. Then we can search for early editions you may not hold.

I never seem to have an easy problem.

Thanks for your continued cooperation.

Sincerely,

A handwritten signature in dark ink, appearing to be 'Eric P. Newman', written in a cursive style.

Eric P. Newman

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

Mr. Philip Lapsansky
Library Company of Philadelphia
1314 Locust St.
Philadelphia, PA 19107-5698

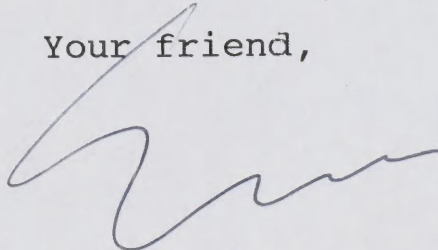
April 25, 1996

Dear Phil:

The coinage article from the Edinburgh encyclopedia is just what I needed. It is different from the other editions and very detailed. It coordinates with the illustrations we have and clears up many matters.

How are you doing on the dating of the broadside. I look forward to your thoughts on that puzzle.

Your friend,

A handwritten signature in dark ink, appearing to be 'Eric P. Newman', written in a cursive style.

Eric P. Newman

ERIC P. NEWMAN NUMISMATIC EDUCATION SOCIETY

6450 Cecil Avenue, St. Louis, Missouri 63105

Philip Lapsansky
Library Company of Philadelphia
1314 Locust St.
Philadelphia, PA 1907-5698

September 18, 1996

Dear Phil:

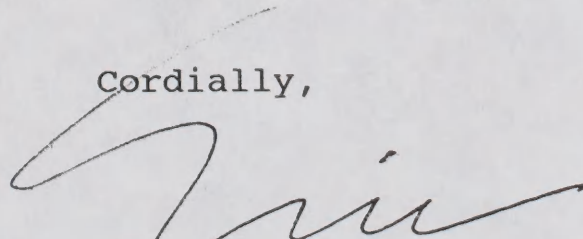
In your April 2, 1996 letter concerning COINING in the American Edition of the New Edinburgh Encyclopaedia (1815) I would appreciate it if you could send me a photocopy of

- (1) The title page of the work.
- (2) The portion of the introduction or preface relating to when the New Edinburgh Encyclopaedia was published in Scotland.
- (3) The article in your 1815 Encyclopaedia entitled MINT (referred to on page 574, first paragraph beginning in column 2.

This will be most helpful. I hope you are wallowing in culture and enjoying all of it.

Please send me a bill for the photocopies. Thank you and best regards.

Cordially,



Eric P. Newman

ranged; but very deficient in instruments. The botanic garden, though not large, is admirably regulated, forming almost an exact counterpart to the garden of Paris. Besides many exotics, it contains a considerable number of plants indigenous in Portugal. In short, the institutions in the university of Coimbra are far from being contemptible; nor are its professors deficient either in genius or learning. But the difficulty and the danger

of publishing, in a country where every work must be printed at the expence of the author, without any prospect of recompence, and where the inquisition reigns in all its terror, repress all their exertions and retard the progress of literature and science. West Long. $8^{\circ} 23' 45''$, North Lat. $40^{\circ} 12' 30''$. See Link's *Travels in Portugal*. (k)

COIN. See BULLION, CURRENCY, and MONEY.

COINING MACHINERY.

COINING, is the art of making metal money, by impressing on its surface such marks as will, at first sight, identify it to be the legal coin, issued by the government of the country where it is current. The impression should be so executed as not to be easily effaced by use, or imitated by counterfeits, and that it should not admit of any reduction from the coin without evidently disfiguring it.

Coining among the ancients, and indeed by the moderns, till within these 250 years, appears to have been very rudely and imperfectly performed, by placing the blank piece of money between two dies, or steel punches, containing the design of the coin, and striking upon the upper one with a hammer. This, which is called hammer money, is always imperfect, from the uncertainty of placing the two dies exactly over each other, when the blank money is between them, and also from the improbability of a man being able to strike a blow with such force as to make all parts of the impression equally perfect. The hammer money continued to be current in England, until the reign of William III. although the more perfect method of coining, by the mill or press, was introduced from France, in the reign of Queen Elizabeth, as early as 1562. The mill did not continue in practice more than 10 years, when the hammer coinage was resumed as being less expensive. Before the hammer money was called in by William III. the English money was in a most wretched condition, having been filed and clipped by natives, as well as foreigners, until it had lost nearly half its value. The milling upon the edges of coins was introduced about this period, (William III.) and such confidence was then placed in this new device, that it was deemed impossible for the coin to be diminished, by clipping or wearing. It was, however, soon discovered, that milled money, either of gold or silver, could be diminished with great facility and expedition, by a process termed *sweating*, which was effected by dissolving a portion from the whole surface of the coin, by an acid, without leaving any evident marks of the fraud. The money was also filed on the edge, and a new milling afterwards impressed upon it, by methods which were soon discovered, notwithstanding the great caution taken by the government to keep the process of milling a profound secret.

The coining press, or mill, is of French origin, and is generally ascribed to Antonie Brucher, an engraver, who, in 1553, first tried it in the French king's (Henry II.) palace, at Paris, for the coining of counters. It continued in use till 1585, in the reign of Henry III. when it was laid aside on account of its being a more expensive method than the hammer coinage. Queen Elizabeth, as we before stated, had a coining press very soon after its first invention, but she soon gave it up for the same reason as the French did. The machine remained in disuse until 1623, when Briot, a French artist, who was unable to persuade the French government to adopt it again,

came to England, where it was immediately put in practice under Briot's direction, who was appointed chief engraver of the mint. Like most other new inventions, it was sometimes used, then laid by, and the hammer resumed during a period of 40 years. But under Charles II. in 1662, the use of the press was completely established in the English mint, as it had been by the French, in 1645; and from the improvement it has made in the neatness and perfection of the coins struck by it, there is no danger of its ever again falling into disuse, especially as the admirable improvements made in it by the late Matthew Boulton, Esq. have rendered it the cheapest possible method, as well as the most perfect. These improvements, which we intend to describe in this article, have been adopted by England, Denmark and Russia, after having being long used at Mr Boulton's works, at Soho, in coining copper, by contract, for many of the governments in Europe; for the East India Company, and the Americans. By their steam engines, they work the presses for cutting out the circular pieces of metal, and afterwards by other presses both faces at once, with such superiority of execution, and cheapness of workmanship, as will greatly prevent clandestine imitation. By this machinery, four boys are capable of striking 20,000 pieces of money in an hour, and the machine acts at the same time as a register, keeping an unerring account of the number of pieces struck.

The coinage of England, from the time of William the Conqueror until 1811, was wholly carried on, in the Tower of London, by a corporation, under the title of the Mint, consisting of a number of Officers, each having their respective duties in the different processes of the coinage. The artizans or workmen were called the Company of Moneyers, and did the work by contract. See MINT.

They employed four kinds of machines; 1st, The rolling mill for laminating the metal to plates of a proper thickness; the cutting out machine, for punching circular pieces from the plates, of the proper size to form the coin; 3d, The machine for milling on the edges; and 4th, The coining press for stamping the impression on both sides at once.

The first operation is the mixing of the metal, because there is no coin of pure gold or silver, a quantity of copper or alloy being always mixed with them, to render the coin harder, and less liable to be diminished by fraud. When the metal is mixed in crucibles, and melted in an air furnace, it is cast into long flat bars or ingots, by the same methods as are used by founders in sand, both with regard to the frames, the manner of working the earth, and the use of the models or patterns. These patterns are flat plates of copper about fifteen inches long, and nearly the thickness of the coin to be struck. The bars or ingots, when taken out of the

moulds, have the sand scraped and brushed off; and are passed several times through the rollers of the mill, to flatten and bring them to the just thickness of the specie to be coined. Before the ingots of gold are passed through the mill, they are annealed, that is, they are heated red in a furnace, and plunged in water, to soften and render the metal more ductile. The silver ingots pass through the mill, just as they are, without any annealing, but are afterwards put into the furnace and left to cool gradually. The plates, whether silver, gold, or copper, being thus reduced as near as possible to their thickness, are cut into round pieces called blanks or planchets, very near the size of the intended specie. This is done with a machine similar to that called by mechanics, a fly press; see Fig. 6. Plate CCI. It consists of a proper iron frame AA, supporting a perpendicular screw B, which has a handle C at the top to work it by, and at the lower end is a cylindrical steel punch *a*, of exactly the same size as the pieces intended to cut out. When it is depressed by the screw, this punch or cutter enters a hole made in a steel dye or bed *b*, which hole is exactly the size of the punch. The slip of plate D being placed over this hole, and the screw turned by its handle, forces the punch through the plate, carrying a round piece with it. The workman guides the plate D with one hand and works the screw C with the other, so as to cut out the pieces with great rapidity.

These pieces are now given to proper officers to be adjusted, and brought, by filing the edges, to the weight of the standard whereby they are to be regulated: the remainder of the plate between the circles is melted again under the denomination of *sizel*. The pieces are adjusted in a fine balance; and those which prove too light are separated from those which are too heavy, the first to be melted again, and the second to be filed down; for the rollers of the flattening mill, by which the plates are reduced, are never so exact, but there will be some inequality in the thickness, causing a difference in the blanks, which inequality may indeed be owing to the quality of the matter, as well as of the machine, some parts being more porous than others.

When the blanks are adjusted, they are carried to the blanching or whitening house, where they have their colour given them; and the silver ones are whitened, which is done by heating them in a furnace, to anneal and soften the metal, and when taken out and cooled, they are boiled successively in two copper vessels with water, containing common salt and tartar, and after that they are scoured well with sand, and washed with common water, then dried over a wood fire in a copper sieve, into which they are put when taken out of the boilers. The planchets are now marked with letters, or graining on the edge, to prevent the clipping and paring of the specie, which is one of the ways wherein the ancient money used to be damaged. The method of performing this operation, in the English mint, is by its very constitution kept a profound secret; but is shewn publicly in the mints of foreign countries. The machine, used by them, for marking or milling the edges, is very simple, yet ingenious; see Plate CCI. Fig. 7. It consists of two plates of steel, *aa* and *bb* in the form of rulers, and about the same thickness as the coin. On the adjacent edges of these the legend or edging is engraved, half on the one, and half on the other. One of these rulers *aa* is immoveable, being strongly bound with clamps to a copper plate *dd*, and that again is fixed to a strong board or table AA. The other plate *bb* is moveable in the di-

rection of its length, and slides on the copper plate *dd*, by means of a handle B, and a pinion D; the teeth of which catch into the teeth of a rack *ee*, attached to the moving ruler *bb*. The distance between the edges of the two rulers is made to correspond with the diameter of the money, by advancing the immoveable ruler towards the other by two screws *ff*. Now the blank being placed horizontally between these two rulers, is carried along by the motion of the moveable one, so that by the time the handle B has made half a turn, it is found marked all round. The Figure shews that the machine will do two blanks at once.

This machine is so easily wrought, that a single man is able to mill twenty thousand blanks in a day. Savang says it was invented by the Sieur Castagin, engineer to the French king, and first used in 1685. But it is certain we had the art of lettering the edges in England long before that time. Witness the crowns and half crowns of Oliver Cromwell, struck in 1658, which, for beauty and perfection, far exceed any French coins we have ever seen.

The planchets being thus prepared, are to be stamped in the coining press, shewn in Fig. 8. of Plate CCI. This machine has a massive iron frame, consisting of two upright sides or cheeks, AA, united by cross pieces or sills, B and C, at top and at bottom. Through the top piece B, a strong perpendicular screw D works in the centre of the frame, and actuates the upper die or steel matrix *a*, on which the impression of the coin is engraved or sunk; this die is fixed in a square slider E, moving in collars *b, b*, attached to the frame A, so that it merely rises and falls by the movement of the screw, without turning round. The lower die *c*, is fixed in the centre of the bottom sill C of the press, being held in a box furnished with screws to adjust it immediately beneath the upper one. The press is wrought by four men. The screw D has a lever, or pair of arms F, F, fixed on the top of it, called by the French *balancier* or fly, from being loaded at the ends with heavy weights *d, d*; and the men pull by ropes or straps G, G, and H, H, fastened at the ends of these arms; another person sits in a hole in the floor before the press, and places the blanks, one by one, upon the lower die *c*; then the two men, by the ropes GG, give a sudden motion to the arms of the fly *dd*, which turning the screw D, presses the upper die upon the money with sufficient force to give it the impression, the momentum acquired by the motion of the weights of the fly giving it a very great power. The recoil of the press, aided by the two workmen who hold the two shafts HH, returns the arms of the fly; then the person beneath puts in another blank, which is struck as before, and in this manner the operation proceeds very rapidly. The blanks having now all their marks and impressions, both on the edges and faces, become money; but they have not currency till they have been weighed and examined by proper officers belonging to the establishment.

In 1811, the Royal Mint was removed from the Tower of London to a very magnificent building erected for the purpose on the east side of Tower-hill, from the designs of Mr Johnson, architect. The system of coining by machinery, practised in this new establishment, was, in great part, invented by the late Matthew Boulton, Esq. His original apparatus was erected at his celebrated works at Soho, near Birmingham, in 1788 and 1789, and was first employed in coining for the East India Company, and some of the earliest copper coins issued by the

French republic. The beauty of the coins which he produced, occasioned him to be employed by contract by our government, to coin the new copper issued in 1797. Since this period, he has recoined an immense number of Spanish dollars, without remelting them; also copper for the East India Company, and several foreign governments; which shewed the advantage of the invention to be so great, that the governments of Russia and Denmark, each procured a complete series of machines from Mr Boulton, under the sanction of acts of Parliament, and erected them in their Mints at Petersburg and Copenhagen. In the new Mint erected on Tower-hill, a complete set of Mr Boulton's machines have been at work since 1811, with great success.

Knowing that it would be highly interesting to our readers, we have obtained a series of drawings of these machines, which are contained in Plates CC. CCI. CCII.

The first of these, at Figs. 1, 2, 3, 4, and 5, contains drawings of the crane and pouring machine, which lifts the melting pots out of the furnace, and pours their contents into the ingot moulds.

Figs. 6 and 7, are the laminating rollers, used for flattening out the ingots into plates of the proper thickness: these plates are cut into narrow slips by the circular shears shewn in Plate CCI. at Fig. 4. The strips are afterwards rolled again, to reduce them to the exact thickness of the intended coin. From these plates circular pieces of blanks are cut out by the machinery represented in Figs. 1, 2, and 3; and after being properly blanchéd and scoured, have their impressions struck in the press represented in Plate CCII.

The furnaces in which the metal is melted, are eight in number, and are so arranged on opposite sides of the melting-house, in two rows of four in each, that the crane, represented in Fig. 1, Plate CC. being placed in the centre between four, will, by turning round upon its centre, come over the centre of any one of the furnaces, and will lift a pot of melted metal from any one of the four; therefore, two cranes so situated, will command the whole. The crane consists of a vertical column AB, fixed firmly in the ground with a flanch at its base; round this the gib C, D, E swings, being united by two collars at C and E, so as to swing freely all round; *e* is a frame of iron, bolted to the gib to support the pivots of the roller or barrel *f*, and also the axis of the pinion *g*, which works the cog-wheel *h* on the end of the barrel; the chain from the barrel passes over the pulley F fixed at the top of the gib, immediately over the centre of the column, and thence proceeds to the pulley D at the extremity of the gib. The frame *e* also supports a third axis *i*, having an endless screw upon it, acting in the teeth of a wheel, fixed upon the main column, so that by turning the winch *k* at the end of this spindle, the whole crane is turned round on its axis. At the extremity of the chain, a pair of tongs G are suspended, the claws of which take hold of two projecting ears of the melting pot, and then it is lifted out of the furnace by turning the handle of the pinion *g*; then by turning the winch *k*, the crane is swung round, and the pot is conducted to the pouring machine.

This machine has an iron frame HH erected from the floor, to support the two pivots *l* of a frame or cradle which receives the melting pot I, and on which pivots it can be inclined, by means of an arch K and proper wheel work, so as to pour its contents into the ingot moulds, which are placed in a carriage L, (shewn separately in Fig. 5.) The cradle for the melting pot is composed of

an axis *e*, on which it swings; a bar *m* proceeding from it, and having the rack K fixed to it at the lower end; also an iron hoop *n*, which embraces the pot round the neck, and has two bars *o* proceeding one on each side to the lower end. The hoop *n*, as well as the latter bars, are united to the axis and the bar *m* by hinges, so that they will open out to receive the pot, but being drawn together by a screw in the hoop at *n*, hold it quite fast: The teeth of the rack K are engaged by a pinion *p*, situated on an axis which goes across the frame, and receives its motion, by equal bevel wheels, from an axis *q*, which is moved by means of equal bevel wheels upon the end of a third axis, parallel with the first; at its opposite extremity this carries a wheel *r*, which is turned by a pinion *s*, having a handle at the extremity of its axis. The object of this train of wheels is, that by turning the handle of the pinion *s*, the workman will be able to incline the rack and melting pot with a very gradual motion, to empty its contents into the moulds. The ingot moulds are made of cast iron, as shewn in Fig. 4, each in two separate halves A, B, having flat surfaces A, B, to form the body of the ingot, and rising edges *ab* composing the sides of the mould; one of the halves has also a similar rise *c* to make the bottom, so that two halves, when put together, form a proper cavity or mould to cast an ingot, as is shewn in Figure 1, which represents the two halves put together ready for casting. The moulds are set up, a great many of them together, in an iron frame mounted on a carriage, shewn sideways in Fig. 2, and endwise in Fig. 3. The carriage is an iron plate LL, moving on four wheels, and having the iron frame MM, NN, for the moulds upon it. This frame has two screws *u* at each end, which being forced up against the moulds P, placed in the frame, hold them all together and in their places, so as to make all the joints tight; they rest upon an iron plate, suspended by two screws *vv*, by which it can be elevated or depressed at pleasure, to suit moulds of different sizes. The carriage runs upon a railway laid across the floor of the melting-house, so as to bring it beneath the pouring machine, as represented in Fig. 1. In this situation, a rack *w*, Figs. 2 and 3, which is fixed to the carriage by small columns, comes where its teeth will engage with a wheel *x*, Fig. 1: This is turned round by a pinion, carrying the handle *y* on the end of its spindle; and therefore by turning this, the wheel *x* communicates a gradual and regular motion to the carriage, bringing the moulds, one by one, beneath the lip of the melting pot, to be filled with metal. The distance of the moulds from the pot can be regulated at pleasure, by shifting the frame MN sideways upon the carriage, which is done by means of a screw at each end, as shewn at W, Fig. 3.

The furnaces in which the metal is melted are extremely well contrived, having the flues for the draught into the chimney proceeding from three different sides towards the top, instead of going altogether from one side, as in common air furnaces, by which means the heat is much more regular, and has not so much tendency to burn away in the throat or flue, as if it were single.

The melting pots, Fig. 5, are made of cast-iron, and of sufficient capacity to hold 400lbs. of metal. They have each a lip or spout *a*, at which the metal is poured out, and two ears *b*, *c*, by which they are taken up with the tongs of the crane, as before described, and lifted into the furnaces. The pot is supported by proper pedestals from the grate of the furnace, and has a large ring of cast iron placed on the top of it to prevent the fuel from

falling into it : As soon as it arrives at a red heat, the metal, properly prepared and mixed, is put in, and occasionally stirred up while it is melting, which takes some hours. The moulds, in this interval, are prepared by warming them in a stove, and when they are taken out to be placed in the frame upon the carriage, the inside surfaces are severally rubbed with a cloth dipped in oil, which preparation, as well as the heating, is found to give the ingot a better surface. When the proper number of moulds are placed in the carriage, as shewn in Fig. 2, the screws *t, t*, at the ends, are screwed fast to fix them all tight ; and in this state they are prepared for casting.

The pot of metal, as before mentioned, is lifted out of the furnace by the crane, then swung round, and lowered down into the cradle *lmno* of the pouring machine, until the ring on the edge of it rests on the iron hoop *n*, which being screwed up tight, holds it fast, and the tongs of the crane are disengaged. One of the attendants now takes the handle *e* in one hand, and *y* in the other ; and by turning the latter of these he advances the carriage forwards, to bring the first mould beneath the lip of the melting pot, then by turning the other he inclines the pot, and pours the metal into the mould ; when this is full, the second is brought beneath it, and so on in succession. The whole four hundred weight is very quickly cast into ingots without any loss or waste, which could scarcely be avoided in any other way of casting. The first metal which is poured from the pot is received in a small iron spoon, and is reserved for the assay master, who examines its quality, and it is not allowed to pass through the succeeding processes, until, from this specimen, he has ascertained it to be standard. A second sample is taken from the middle of the pot, and a third from the last of it. The pouring machine was, we understand, invented by Mr Morrison, an officer of the Mint.

The ingots thus cast are about 10 inches long, 7 broad, and 6 tenths of an inch thick. They are next carried to the rolling mill, which is represented in Figs. 6. and 7. in Plate CC. In the former, A represents a large cog wheel, fixed on the extremity of a long horizontal shaft BB, extending beneath the whole mill : This wheel and shaft receive their motion from a smaller wheel, fixed on the main or flay wheel shaft of a steam engine of 36 horse power. The main shaft B of the rolling mill has wheels C, D, E, fixed upon it, to give motion to the respective rollers, which are mounted at F and G, in strong iron frames bolted to the iron sills *a a*, which extend through the whole length of the mill, and rest upon the masonry, in which the wheels are concealed. The two large wheels C and E give motion to the wheels H, I, which are supported on bearings between two standards *b b* bolted down to the ground sills ; as is also shewn at *b b* in the perspective view, Fig. 6. On the ends of the axes of these wheels are heads for the reception of coupling boxes *d d*, which unite them to short connecting shafts K, L ; and these again, by means of coupling boxes, convey motion to the upper rollers *e e* of each pair, at F and G. The middle wheel D upon the main shaft B gives motion to the lower rollers in a similar manner, thus : It turns the wheel M, by means of an intermediate wheel, not shewn in the Figures. This, at each end of its axis, gives motion to the lower rollers FF by the connecting shaft *g g*. By this ingenious arrangement, both the rollers *e, f*, of each frame, receive their motion from the main shaft with equal velocity, and by means of wheels of large radius, which act with much more certainty than the small pinions usually employed in roll-

ing mills, to connect the upper and lower rollers, and cause them to move together. The wheel M, in consequence of its intermediate wheel, revolves in a contrary direction to the wheels H, I ; but all the pairs of wheels being of equal diameters, and having the same numbers of teeth, they revolve in precisely the same period ; and the two rollers *e, f*, being of the same diameter, their surfaces accompany each other, without which the metal rolled between them would be buckled ; that is, one side being more expanded than the other, would render the plate convex. The connecting shafts K L and *g g*, and coupling boxes *d d*, which give motion to the rollers, have sufficient play in their joints to allow that small deviation which takes place, when the rollers are set nearer together for reducing the plate to its intended thickness. The detail respecting the frame, and parts of the rollers, is explained by the perspective view, Fig. 7. in which *a* represents one of the sills before mentioned, which runs through the whole length of the mill ; upon these are bolted the two cheeks, or side frames of the rollers, marked NN : Each of these has a large mortise, or opening in it, to receive the bearings for the necks or gudgeons of the rollers *e f*, between which the metal is passed. Their distance from each other, and consequently the thickness of the rolled plate, is regulated by two strong screws OO, passing through the upper part of the cheeks of the frame, and their points pressing upon the bearings PP, or the pivots of the upper roller. The weight of the roller is suspended by two bolts, passing through the frame, and they are united to a collar Q, which is fitted on the upper end of the screws ; and this collar being a long plate, is common to both screws, as the Figure shews. Immediately above this plate, the screws have wheels RR fitted upon them, which are cut with teeth on the lower part of them, to receive motion from two endless screws, formed upon a spindle SS, which moves in bearings projecting from the plate Q. By turning this spindle, its endless screws act upon the wheels RR, to turn them round ; and the great screws partaking of the same motion, elevate or depress the upper roller *e*, with so delicate a movement, that it can be adjusted to roll the plate to the greatest nicety ; and the adjustment being made at both ends at the same time, the two rollers always preserve their parallelism. The metal, when introduced to the rollers, is placed upon a small table V, fixed between the frames NN. Its upper surface being exactly level with the top of the lower rollers, it is fastened by means of a cross bar T, and wedges, which press it fast up against projecting pieces of the frames.

The cheeks NN of the frame, are connected by strong wrought iron bolts, which are too plainly shewn in the figure to require any particular description.

The rolling mill contains four pair of rollers, each driven by its train of wheel work as shewn in Fig. 6 ; the mill therefore consists of two such sets of wheels and rollers, as are represented in Fig. 6. The two shafts are situated parallel to each other, and receive their motion from the same steam engine ; the wheel before mentioned, which is on the main axis of it, being situated between them, and giving motion to one of the main wheels AA on each side. The whole machine forms the most complete rolling mill we have ever seen, and the workmanship of it is unrivalled : It was executed by the celebrated engineer John Rennie, Esq.

The ingots of silver are heated to redness in a furnace before they are rolled. The two furnaces for this purpose

are situated before two pair of rollers, which are therefore termed breaking down rollers, being used to consolidate the metal by rolling whilst hot. In the operation, two men are employed; one takes the metal from the furnace by a pair of tongs, and introduces it between the rollers; the other catches it as it comes through, and lifting it over the top roller, returns it to the first, who puts it through again, having previously turned the handle S a small quantity, to set the rollers nearer together. After having been rolled in this manner four or five times, they are reduced to near two-tenths of an inch in thickness, and increased in length to about four times the breadth of the ingot; for it should be observed, that the ingots are rolled across their breadth, the longest side being presented to the rollers; and as the rollers do not extend the plate sidewise, the plates, when finished, are as broad as the length of the ingots, viz. 10 inches, and three or four times as long as the breadth of the ingot, *i. e.* from 21 to 28 inches. These plates whilst still warm, are rubbed over with a weak solution of acid or *fickle*, to remove the colour produced by the heat, and are then cut up into narrow slips across the breadth of the plate, by means of the circular shears, Fig. 4. Plate CCI. This machine is worked by a cog wheel at the extremity of the main shaft B, Fig. 6, of the rolling mill. It consists of a framing of iron AA, supporting two shafts BB, which are parallel to each other, and move together by means of two equal cog wheels CC, the lower one of which works with the teeth of the great wheel above mentioned, upon the main shaft of the rolling mill. At the extremities of the two shafts, wheels or circular cutters are fixed, their edges overlapping each other a small quantity, as is shewn in the edge view, Fig. 5. Here it is seen that each cutter has a rim of smaller diameter than the outside: this small rim in the top cutter is behind it at *e*, but is in front of the lower one at *g*, so that the adjacent edges of the large rims *f* and *k* come in contact, and overlap each other a small quantity. By this means they act in the same manner as shears, to cut any thing, as *c, d*, which is interposed between them, by depressing one half *d*, and elevating the other *c*, till they are completely separated. F, Fig. 4, represents a shelf on which the plate is laid, and advanced forwards to present it to the cutter; and G is a ledge or guide, screwed down upon it, to guide the metal, and, by its distance behind the planes of the cutters, to regulate the breadth of the piece which shall be cut off; for this purpose the screws which fasten down the ledge are fitted in oblong holes, which admit of small adjustment. The workman holds the plate flat down upon the surface F, and advancing it towards the shears, they will continue to draw it through, when they once take hold, until they have cut the whole length. *c d*, Fig. 5, shews a section of the plate to explain the manner in which it is cut: The part *c* is conveyed upon the top of the rim *k* of the lower cutter, and kept down from rising by the small diameter *e* of the upper cutter; at the same time, the other part of the plate is depressed by the rim *f* of the upper cutter, and supported by the small rim *g* of the lower one. By this means, the divided parts *c* and *d* are prevented from curling up into scrolls, as they will, when cut in a common pair of shears, because the small parts *e* and *g* keep them straight. Behind the standard, supporting the back pivots of the shafts BB of the cutter, is a frame *l*, with a screw *m* tapped through it. This is used to draw the axis of the upper cutter D endwise, and keep its edge in close contact with the edge of the

other cutter E. The slips of plate are now carried to the other two pair of rollers in the rolling mill, which are made of case-hardened iron, and with a better polish on their surface than the breaking down rollers. The plates are passed cold between these, to bring them exactly to the requisite thickness; hence they are called the adjusting or planishing rollers. The workman here tries every piece as it comes through by the gauge, Plate CC. Fig. 8. This is a piece of steel, having a notch in it, the inside lines of which are very straight, and inclined to each other at a very acute angle. They are divided, as is shewn in the Figure, so that the edge of the plate being pressed into the notch, will have its exact thickness determined by the distance it will go into it, the divisions shewing the dimensions in parts of an inch.

In rolling the plate the second time, they pass all the slips successively through the rollers, then adjust the rollers by the handle, and pass them all through a second time. This is repeated three or four times, and the last time they are every one tried by the gauge, and sorted by it into as many parcels as they find different thicknesses; for it is a curious fact, that though the rollers are 14 inches in diameter, and the frame proportionally strong, still they will yield, in some degree, so as to reduce a thick plate in a less degree than a thin one; and the plates which have all passed through the same rollers will be of three or four different thicknesses, which being sorted by the gauge into as many parcels, they begin to reduce them to the exact quantity, by setting the roller according to each parcel: then the first of the parcel which comes through is tried, by cutting out a circular piece with a small hand machine, Fig. 6. Plate CCI. and weighing it: If it proves too light or too heavy, the rollers are adjusted accordingly, till, by a few trials, they are got right, and then all the parcel is rolled through. The next parcel is then tried, and so on; the trial plates which are too thin being returned as waste to the melting house. By these precautions, the blanks when cut out by the next machine will be very nearly all the same weight, which they would scarcely be even if the gauge determined all the plates to the same thickness, because some being more condensed than others, they could not all have the same specific gravity.

The cutting out machine is explained by Figures 1, 2, and 3, Plate CCI. or at least sufficient is there shewn to describe the whole. AA is a basement of stone to support an iron plate BB. On this, columns CC are erected to sustain the upper part D of the frame. The iron frame of the machine, marked EEF, is fixed down upon the iron plate B: it has a screw *a* fitted through the upper part, which acts upon a slider *b*, supported by a cross bar *c* of the frame: it is cylindrical, but has a leaf or fillet on the front side, to prevent it from turning round. The punch *d* is fixed in the lower end of it, and immediately beneath it is the die or bed *e*, which is adjustable, by screws, to its true position. These parts are very nearly the same as the original cutting out machine; but the manner of actuating it, by the power of a steam engine instead of hand labour, constitutes the improvement. Above the screw is an axis G, fitted on the top of the screw, with a socket, and the upper end supported by the frame D: above this support, a lever NH is fixed to the axis, to receive the action of cams or wipers fixed on a large horizontal wheel, situated behind the machine. This wheel is shewn in Fig. 2, in which KK is a plan of part of its rim, and L one of its cams. In its revolution, it intercepts the roller *g*, at the extremity of the lever

H, and by moving it outwards, raises up the screw; but the moment it has passed by, the screw is returned, to cut the plate, by the re-action of a spring, which draws the rod M. This is attached to the arm N, of the lever HN, and therefore draws the roller *g* back the instant the cam has passed by. The rod M draws from a link *m* fitted upon the arm N of the lever, and moveable along it by means of a screw *n*, so as to adjust the power of it at pleasure, by throwing its action at a greater or less distance from the centre of motion G. The motion of the machine can be discontinued at pleasure by means of a catch, Fig. 3; it is marked OP, and moves on the centre P, being constantly pressed upwards by the spring *r*. This catch is situated crosswise beneath the arm N of the lever, and when that lever comes back, the hook O catches and holds it up, so as to prevent its return. When the machine is required to work, the string *s* is pulled, to draw down the catch beneath the plane of the lever's motion. This string, as shewn in Fig. 1, comes down to a treddle R, on the ground, before the machine. The boy who attends the machine, places the plate over the bed *e*, and puts his foot on the treddle when he wishes the machine to work. This relieves the lever N from the catch, and then, every time the cam of the wheel K comes by, it lifts the roller *g*, and raises the punch; but as soon as the cam has passed, the spring makes a stroke, and cuts out a piece of plate, which drops through the bed, and falls out at a spout T. The instant he relieves the treddle, the machine stops, but still the point of the cam strikes the roller *g* every time it comes by. This is avoided when the machine is to be permanently stopped, by the following means: The centre P, of the catch O P, is fixed at the end of a lever, moving on a centre W, Fig. 3, and having a long handle W X, Fig. 1; therefore, in pulling this lever, the catch is drawn forwards, and raises the roller *g* quite out of the reach of the cam L. The lower end of the lever, Fig. 1, moves in a notch in the plate B, and thus retains it when it is drawn forwards. Z is a lever fixed on the axis G, and carrying a sweep, or arch, at the extremity of which is a weight or fly *w*, to give impetus to the stroke of the machine; this is checked, when, at the end of its motion, it strikes against a strong vertical wood spring Y, firmly fixed to the framing. The two wheels *x* which are indented into each other, are to connect the axis G with the socket fitted at the top of the screw *e*, and there admit of adjustment, by turning the screw round a small quantity, with respect to the lever H, to give a greater or less motion to the screw. The Figure shews the clamps which hold the wheels together. The Figures in our Plate, though they explain the construction of the machine, do not exhibit the real appearance of it, because there are twelve of these machines, all mounted on the same frame. They are contained in a very elegant circular room, lighted by a skylight, in the centre. The stone basement A A, Fig. 1, is a circular wall, and the plate B, a ring surmounting it; there are twelve of the columns C supporting a circular iron ring, or frame D; and this has some curious cross framing in it, to support the axis of the wheel K K: this, of course, is common to all the twelve presses, which are situated between each pair of the columns C. An immense horizontal fly wheel is fixed on the axis above the wheel to regulate the motion. The springs of the rods N, are concealed within twelve columns, which ornament the room, and appear to support the ceiling. The whole is moved by a steam engine of sixteen horse power.

The blanks thus cut are next to be adjusted by filing the edges, to bring them to the exact weight; but by the system adopted in the last rolling very little adjustment is requisite, and as soon as this is performed, the edge is milled. This operation, as before mentioned, is not shewn in our mint; but we believe Mr Boulton has improved this process as well as the others; at least some of his coins have milling of a kind very different from any other, and which, we think, could not be done by the machine we have represented in Plate CCI.

The coining press, which is the most beautiful machine of the whole series, comes next to be described, (see Plate CCH,) which is a perspective view of one of the presses complete: A A is a solid stone basement supporting the whole; upon it are erected four columns, rising to the ceiling of the room, and in the centre between these, the press is placed. Its frame marked K K, is screwed down by four bolts shewn at the bottom; *b* is the screw, or rather the spindle of it, the screw itself being concealed within the frame of the press. On the top of the spindle, the fly D B is fixed, and over this a hollow spindle C, like an inverted trumpet, conveying the motion to the press, from machinery contained in the apartment above. The weights B D, at the extremities of the arms of the fly, are limited in the quantity of their motion, by checks affixed to iron beams E and F, extending from one of the columns to the other: These receive the blow of the fly, in case the press should ever make a stroke without a blank being between the dies, and are therefore made exceedingly strong; the columns are of oak. The recoil of the fly, after having struck a coin, is checked by its coming against a piece of wood G, which is fitted into the tube H, fixed to the iron beam E, and having a concealed spring to ease the blow. The upper or moving die is beneath the screw; for this press has no slider like the old one, but the die turns round with it whilst it is making the impression. The screw *b b* is, as the Figure shews, cylindrical at each end, and is fitted in very accurate bearings, adjustable by screws at *a a* above, and at *c c* below; between these it is cut into a worm or screw, and is received in a proper nut, but it depends on this only for its ascent and descent, the fittings at the ends keeping it truly vertical. Fig. 5. explains, by an enlarged view, the connection of the upper die with the screw at this place; *b* is the lower point of the screw; it has a ring *d* fixed on it, having a leaf or tooth projecting downwards, and entering a recess made in a ring *e*, of similar dimensions, which is the upper part of a piece *f*, forming a box, furnished with screws, to hold the upper die; the point of the screw acts upon this piece, and to keep it always in contact therewith, the ring *e* is suspended in a collar *g*; this has two arms, to which bolts *h h* are united by screws; and these bolts (see Fig. 1.) passing up through holes in the solid frame, are united to another collar *k*, which fits on the screw, and rests upon a shoulder formed on it; so that by the adjusting screws on the rods *h*, the collar is always kept tight, and accompanies the screw in its motion. The lower die *l*, Fig. 2. is held in a box I, furnished with adjusting screws, which box is screwed down upon the bottom of the frame of the press, as is seen in Fig. 1. Now a piece of metal being placed on the upper die when the machinery moves the press, and forces the upper die down upon it, the tooth of the ring *d*, Fig. 5. obliges the die to turn with it, so that the coin is struck with a twisting motion, which is supposed to give a better impression; but in the recoil of the screw the

die does not at first turn round, or it would inevitably cut away all the raised parts of the impression. This is effected by giving the tooth of the ring *d* considerable latitude in the opening made in the other ring for its reception, and this allows the screw to raise the die quite clear of the coin before it partakes of the twist of the screw.

All the coins in this press are enclosed in a steel ring whilst they are struck, which method we believe was introduced by Mr Lawson, an agent of Mr Boulton, and now an officer in the mint. It is very ingeniously contrived to force out the money from it, which becomes jammed very fast into it, by the expansion of the metal. The lower die *l*, as shewn in Fig. 2. is at top reduced to a neck only the size of the money it is to coin, and upon it is fitted the steel ring *K*, Fig. 3; this slides freely up and down upon the neck of the die, but has always a tendency to rise up upon it by the action of a triple spring *M* surrounding the die beneath the ring. It is occasionally depressed by two levers *i i*, Fig. 4, affixed by centre pins to a ring *N*, which is fixed on the outside of the box *I*, Fig. 2. holding the lower die *l*. The inside ends of these levers *i i*, act upon the outside of the steel ring *K*, and the other ends are forked to admit chocks *m*, attached to the lower ends of the rods *h h*, and guided by the anterior edges of the frame, as shewn in Fig. 1: these, by elevating the tails of the levers *i* whenever the screw rises, depress the opposite ends, and the ring with them. Then, suppose the screw at the highest point of its movement, the ring will be at the bottom and its upper surface level with the surface of the lower die; now place a blank thereon, and when the screw of the press comes down, the rods descend with it, and the levers permit the springs *M*, beneath the ring *K*, to raise it up, and completely inclose the coin before the upper die comes upon it to strike the impression, which being done, and the screw beginning to return with the rods *h*, they elevate the tails of the levers, and thrust the ring down, leaving the coin loose upon the die, which being removed, and another blank placed upon it, the same operation is repeated.

The blanks are in this machine fed, or placed successively on the lower die, by very ingenious mechanism, which is represented on an enlarged scale in Figs. 6, 7, and 8. Its connection with the press can be seen in Fig. 1, where *o n p* is a lever, moveable on a centre *n*, and actuated at the upper end by a curved sector *o*, attached to the upper extremity of the screw *b*. This is so curved, that in the reciprocating motion of the screw, the end of the lever moves alternately to and from the centre of the press. It is guided to move with steadiness, by fitting in a grove *r*. At the lower end it gives motion to a slider *P*, which carries the blanks singly from a tube, in which they are deposited, and lays them upon the lower die, then returns to fetch others. This slider is fitted in a brass frame or socket *R*, attached to the frame of the press. Thus, a piece of iron *r*, Fig. 1, is screwed to the check *K* of the press, with latitude for adjustment. To this the socket *R* is attached, by means shewn in Fig. 6. The projecting part *s* enters a notch in the upright side of *r*, Fig. 1, and by a centre pin is attached, like a joint, that it can swing round horizontally. The projecting leaf *t*, Fig. 6, embraces the opposite side of *r*, Fig. 1, and having a screw through it, fixes it fast, but admits of adjustment to make the slider carry the blank exactly to the right place. The socket *R*, Fig. 6, consists of two plates *R* and *S*. The projections *t* and *s*

being part of the lower one *S*, and the upper one *R* is attached to it by screws and a leaf *v*, so that they are parallel to each other, but leave sufficient space between to receive the steel slider *P*, called the tongs. *Q* is a tube, into which the blanks are put, ten or a dozen at once, and are taken away one at a time by the tongs: These are shewn detached in Fig. 7. The principal piece is a ruler of steel *w*, to which the other piece *x* is connected by the joint *y*. The end forms a circular opening *1* for the reception of the blank, but will leave it when *x* is opened; *2* is a hook, which, when the tongs advance, enters a socket fixed behind the press; and this being adjustable by screws, ensures its leaving the blank in the exact position. The motion is given to the tongs by a frame of steel *3*, Fig. 6. It slides in front of the socket *RS*, having a pin *4*, which enters a fork in the lower end of the lever *o n p*, Fig. 1: It also extends beneath the lower brass plate *S*, and has three studs, or pins, which rise up from it, and passing through 3 grooves in the bottom plate *S*, reach the tongs *w*, and give them motion. This is shewn in Fig. 8, which is a plan of the sliding frame *3, 4*; and *5, 6, 7* are 3 studs. The latter of these enters an opening *y*, Fig. 7, in the blade *w* of the tongs, where it has a small latitude of motion. The other two studs *5, 6*, include the moving half *x* of the tongs between them, near the joint *y*, and act upon surfaces or edges thereof, which are inclined to the direction of motion for the tongs and slider. Its operation is thus: Suppose the tongs drawn back as far as they can be in this situation, the circular opening *1* in the tongs comes exactly beneath the tube *Q*, Fig. 6, and a blank falls down into the opening. Now, suppose the frame *3, 4*, moved forward by the lever *o, n, p*, acting upon the pin *4*, its two studs *5, 6*, which include the moving blade *x*, tend to shut the tongs up. This grips upon the edge of the blank, and holds it fast between them whilst it advances, till it comes exactly over the lower die, to which position it is determined, and stopped by the hook *2* entering the socket before mentioned. In returning, the studs *5, 6*, will evidently open the tongs before they communicate any motion to them, and will therefore leave the blank exactly where it was placed, and return empty to fetch another. It stops when it comes beneath the tube *Q*, and another blank falls into the opening *1*; but the instant the advancing motion commences, the tongs close up, and hold it tight, as before mentioned. The lever *o, n, p*, Fig. 1, is made with a joint in it near the lower end, and is furnished with two springs, which act in the same manner as the springs in the back of a knife, to keep it straight, and carry the tongs forward; but if any obstruction arises, the lever bends, without forcing the tongs or slider forwards to break them. The centre *n* of the lever is adjustable to regulate the length of its motion by a sliding centre, which is fitted upon a vertical bar *9*, attached to the frame.

We have now described all the parts of this very ingenious machine; but it will be proper to say a few words on the manner of their action. The only attention the machine requires, is that of a little boy, who stands in a sunk place before the press, and always keeps the tube *Q* full of blanks. He has two strings, one of which will, when pulled, put the press in motion by the concealed mechanism in the room above, and by snatching the other string the press stops. Now, suppose the screw and upper die at the highest of their movement; the ball *B* of the fly, close to the end of the pole *G*; the lever *o, n, p*, and tongs *P*, in a contrary position to that of Fig. 1. viz.

holding a blank exactly over the lower die; the ring forced down upon the neck of the die; in this state, by pulling one of the strings, the press starts the screw *b*, and the upper die begins to descend, the tongs open and then withdraw, leaving the blank upon the die. As the motion continues, the small levers *i, i*, suffer the steel ring *K* to rise up by its springs *M*, and inclose the blank. Lastly, the upper die comes down, and strikes the coin with a twisting motion; the recoil and the concealed mechanism immediately causes its return; but the upper die does not partake of the twist of the screw, till the money is relieved. The tongs seize one of the blanks from the tube *Q*, and then carry it forwards, at the same time the small levers *i, i*, depress the steel ring *K*, and leave the coin loose upon the die; then the end of the tongs approaching with another blank, throw it forward into a box behind the press. The next stroke instantly succeeds, repeating the operation at the rate of 60 and 70 per minute, and that with very few interruptions for the whole day. The press-room contains eight machines, all supported on the same stone base; and the iron beams *EF* between the columns, serve equally for the presses on each side: The whole has a very grand effect. The eight presses will strike more than 19,000 coins in an hour, with only a child to supply each. The grand improvement in these presses consists, 1st, in the precision with which it operates to strike every coin with equal force, which could not be insured by the old press, worked by manual labour. 2d. The rising collar or steel ring in which they are struck, keeps them all of one size, and makes a fair edge, which the old coins never had, being rounded and defaced by the expansion of the metal under the blow. 3d. The twisting motion of the upper die is thought to produce a better surface to the flat parts of the coin, but of this there may be some doubt. 4th, The feeding mechanism is very complete, and allows the machine to work much quicker than in the old press, where the workman being in constant danger of having his fingers caught, was obliged to proceed cautiously, as well as to place the coin true on the die, which was however seldom done perfectly.

The want of feeding apparatus has been long felt as a great defect in the old coining press. In 1731, M. Du Buisson presented to the Royal Academy of Paris, a project for an apparatus to place the blanks upon the dies without depending upon the care of the workmen: It consisted of two sliders, one applied upon the other. The upper one had a hole in it for the reception of the money, the other was only a flat plate, to keep it from falling through. These sliders having taken a blank from a tube where they were deposited, were both advanced together by the movement of the press towards the die, and displacing the piece already struck from the lower die, laid the blank upon it, the lower slider proceeding no farther than the edge of the die. The whole contrivance was imperfect and awkward, but deserves to be recorded as perhaps the first attempt. See *Machines Approuvées par L'Académie*, 1731, vol. v. p. 155.

The feeding mechanism of Mr Boulton's press is also a French invention, as appears from a pamphlet entitled, *Rapport fait à la classe, des Sciences Mathématiques et Physiques, de L'Institut National; sur diverses Inventions de Jean Pierre Droz, relatives à L'Art du Monnoyage*. In this report a coining press, with the feeding apparatus like that which we have described, is minutely detailed, and also several other inventions which display much ingenuity; but they are not so complete as

Mr Boulton's contrivances for the same purposes, who, by the application of his steam engine to put them in motion, as well as by several improvements in the making of the dies, has carried the art of coining to a degree of perfection hitherto unknown. (J. F.)

COIX, a genus of plants of the class Monœcia, and order Triandria. See BOTANY, p. 314.

COKE, SIR EDWARD, Lord Chief Justice of England, and one of the most distinguished lawyers whom his country has produced, was born of a good family, at his father's seat at Mileham in the county of Norfolk, in the year 1550.

A liberal course of education, according to the forms of discipline established at that period, contributed to bring to maturity those great talents, which were afterwards exerted, with so much benefit to his country, in the affairs of public life. At the age of ten, he was placed at the free-school at Norwich, whence he repaired to Trinity College, Cambridge, where he remained about four years. He then removed to Clifford's Inn, and, in the following year, was entered a student of the Inner Temple.

While in this situation, he already began to exhibit extraordinary proofs of his proficiency in the study of legal science, and of those acute powers of mind, for which at a more mature age, he became so highly distinguished. These proofs of application and ability did not pass without observation and reward; for at six years standing, he was called to the bar; which was reckoned unusually early in those strict times. The first cause in which he appeared, in the court of Queen's Bench, was a remarkable action upon the statute *de scandalis magnatum*, in Trinity term 1578, which seems to have excited considerable interest, and of which he himself has given a judicious report. (See Rep. P. iv. fol. 12. b. 14. b.) About the same period, he was appointed reader of Lyon's Inn; which situation he continued to fill during three years; and, by means of his lectures, which were much resorted to, he increased his reputation and his practice.

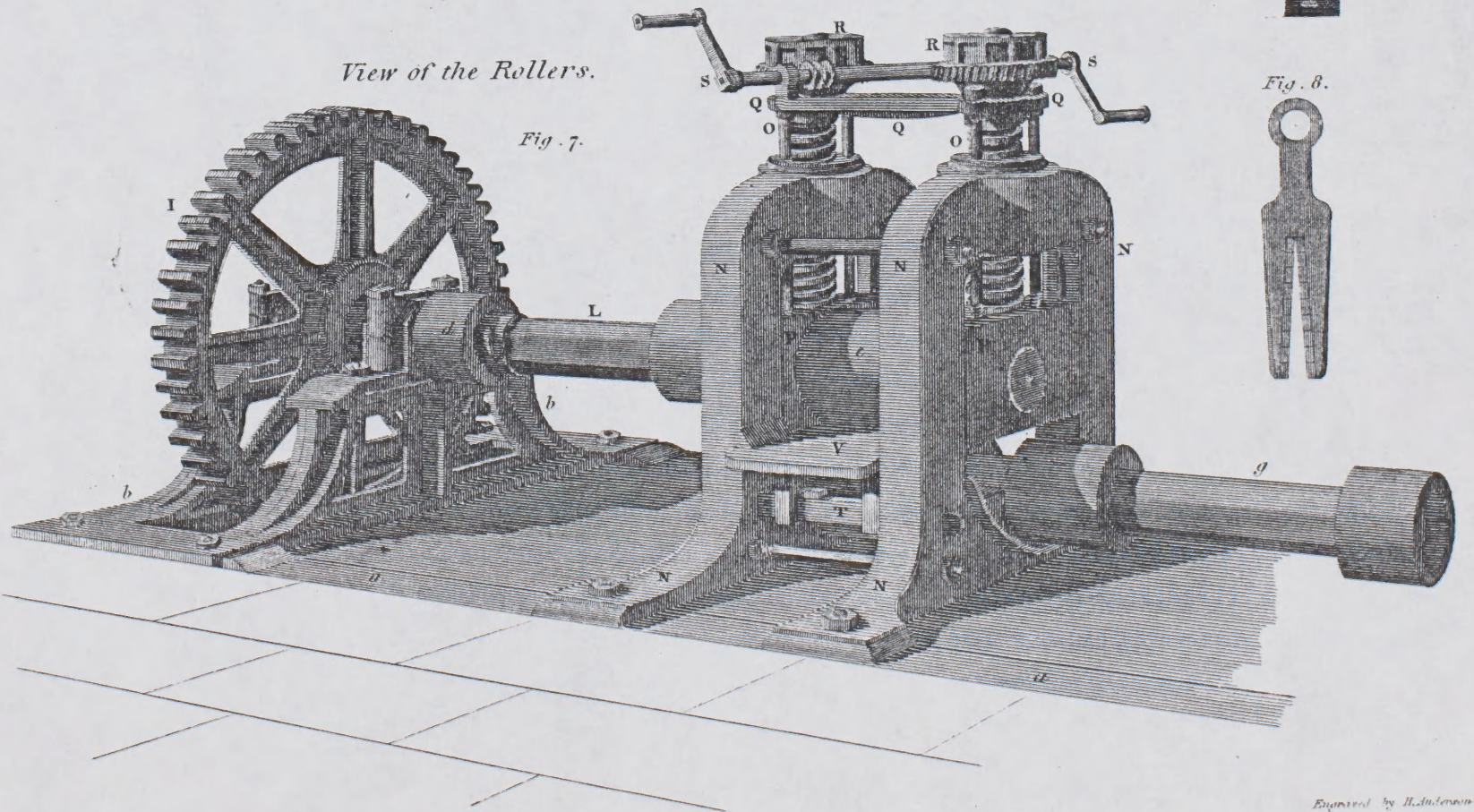
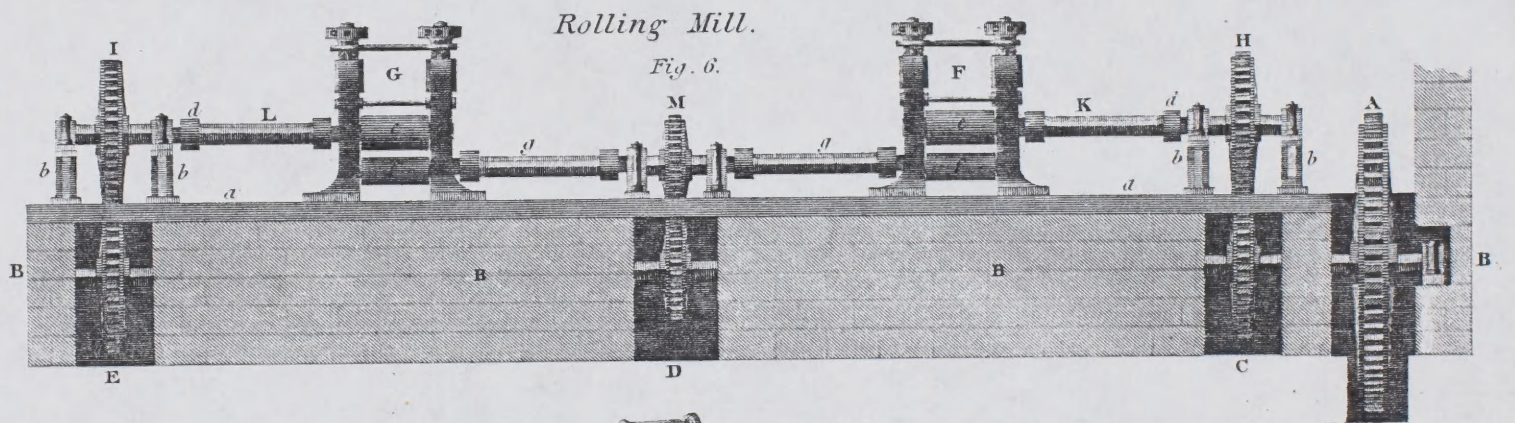
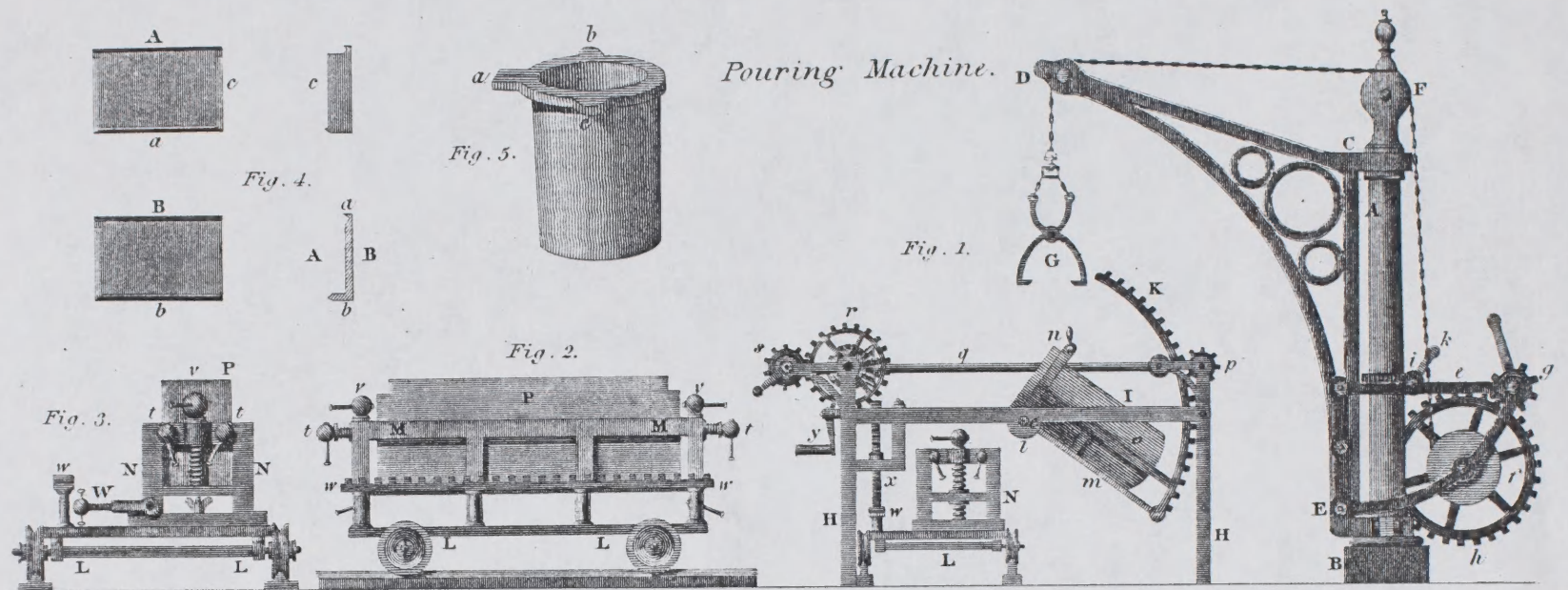
From this period he rose very rapidly in his profession; was chosen recorder of the cities of Coventry and Norwich; appeared in all the great causes which were tried in Westminster Hall; and was elected knight of the shire by the freeholders of Norfolk. He filled, successively, the offices of solicitor and attorney general to the queen; and in the parliament held in the 35th year of Elizabeth, he had the honour of being chosen speaker. Towards the latter end of the reign of that princess, such was the degree of eminence to which he had attained, that he was constantly consulted by her majesty's ministers upon every matter of difficulty; and such was the estimation in which his talents and integrity were generally held, that, with his sanction, many measures, which might otherwise have appeared unusual and arbitrary, were rendered agreeable to the feelings of the people.

As attorney-general, he took a very active part in the conduct of the various and important state trials, which occurred in that and the succeeding reign. In the proceedings against the Earl of Essex, Sir Walter Raleigh, and the gun-powder traitors, he displayed uncommon vigilance, sagacity, legal knowledge, and oratorical powers; although in some of these, particularly during the trial of the unfortunate Raleigh, the lustre of his great talents was, in some measure, obscured by his intemperate behaviour and insulting language towards the accused, for which it were difficult to find an apology. In

COINING.

PLATE CC.

Machinery used in the Royal Mint.



COINING.

PLATE CCI.

Machinery used in the Royal Mint.

Cutting out Machine.

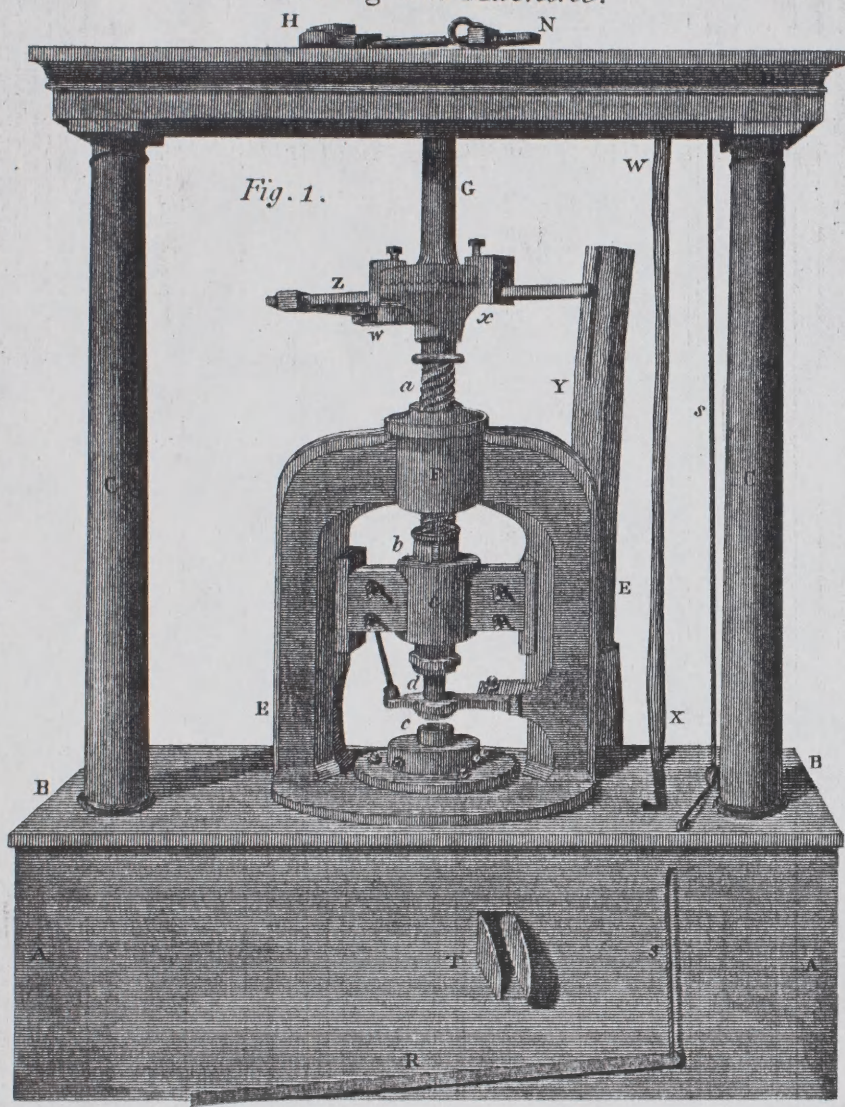


Fig. 2.

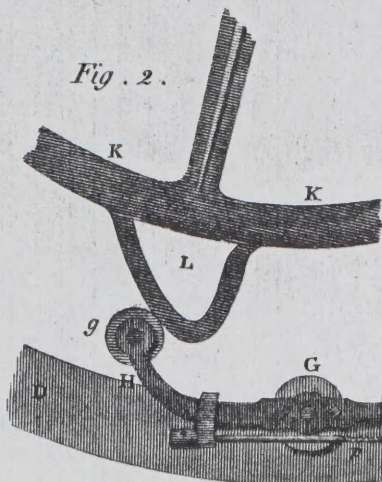


Fig. 3.



Circular Shears.

Fig. 4.

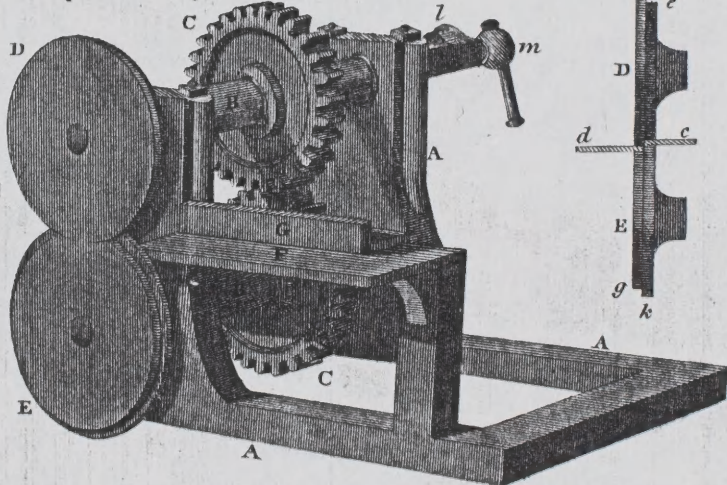


Fig. 5.

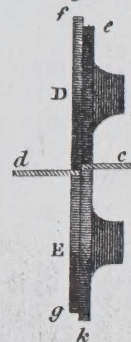
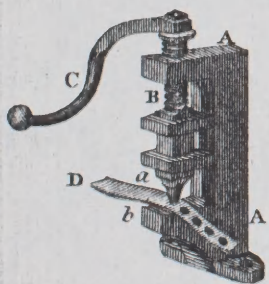


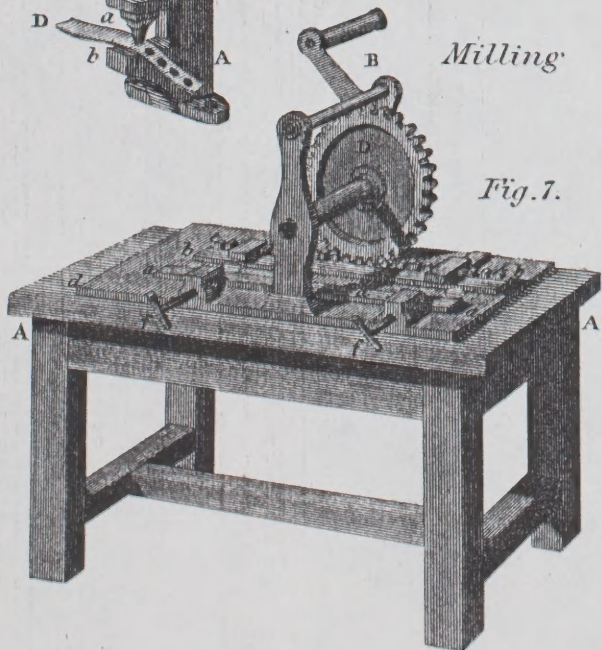
Fig. 6.

Old Coining Apparatus used in the Tower.



Milling

Fig. 7.



Coining Press.

Fig. 8.

